Voluntary Cleanup Plan Application for the Rose Walsh Smelter Site Silverton, Colorado

Prepared for

Colorado Department of Public Health and Environment

Prepared for

San Juan County, Colorado

Prepared by

SWCA Environmental Consultants
HWS Consulting Group

September 2009

VOLUNTARY CLEANUP PLAN APPLICATION

FOR THE

ROSE WALSH SMELTER SITE
SILVERTON, COLORADO

September 2009

Prepared For:

SAN JUAN COUNTY
1557 Greene Street, P.O. Box 477
Silverton, Colorado 81433

Prepared By:

SWCA Environmental Consultants
515 East College Drive
Durango, Colorado 81301

and

HWS Consulting Group Inc.
7951 E. Maplewood Ave., #122
Greenwood Village, Colorado 80111

EXECUTIVE SUMMARY

San Juan County ("the Applicant") submits this Voluntary Cleanup Plan (VCUP) Application as a request for inclusion in the Colorado Department of Public Health and Environment's (CDPHE's) Voluntary Cleanup Program for real property known as the Rose Walsh Smelter Site (referred to hereafter as the "Smelter Site") located in San Juan County, Colorado near the Town of Silverton (Figure 1).

Upon approval of this VCUP Application by the CDPHE, San Juan County plans to complete the VCUP implementation and CDPHE reporting requirements. San Juan County plans to develop the Smelter Site for affordable/attainable housing, parks, trails, historic interpretation, and undeveloped open space. San Juan County and the Town of Silverton will retain ownership of the publicly used portions of the Smelter Site, and will sell residential lots to qualified buyers as affordable and attainable housing or to market-rate buyers to offset the cost of development. Following the completion of the VCUP, it is assumed that the VCUP will transfer to the new owner of the properties. Upon completion of the VCUP, the applicant will certify that the plan has been implemented as proposed and petition CDPHE for a No Action Determination (NAD). This NAD request may be bifuricated into specific parcels, if necessary, to facilitate the transaction (title Transfer) of property to future property owners.

The Smelter Site is a 13.8 acre parcel divided by Highway 550, immediately southwest of the Town of Silverton in unincorporated San Juan County. The property is described as Parcel Number 4829-0.00-0.1-032 by San Juan County and is known as Tract B of the Ophir Placer (San Juan County 2005a). To the north of the site are a residential lot and the Miner's Shrine. Directly west of the property is undeveloped mountainside and some unnamed old mine adits. To the northeast of the site is the town of Silverton and east of the Smelter Site is undeveloped land that adjoins the Silverton Town limits. The southwest portion of the site on the south side of U.S. Highway 550 is in the floodplain of Mineral Creek (Plateau Environmental Services, Inc [Plateau] 2003, 2004); this portion of the property south of Highway 550 is not included in this VCUP application and clean up action.

The Smelter Site has been graded and contoured with several benches to accommodate buildings and other structures associated with the former Rose Walsh Smelter operations. While no structures remain on the property, foundation remnants, metal fragments, cinders and slag are present on the site. Presently, the Smelter Site contains wooden footings and several unimproved roads and trails. The citizens of Silverton and San Juan County currently use the area and abandoned railroad grade as undeveloped open space and trails.

At the Smelter Site, the geology consists of unconsolidated sand and gravel deposits from Mineral Creek riparian terraces and glacial till deposits. The riparian terraces contain predominantly sand and gravel with numerous cobble and boulders. The glacial till is unconsolidated and poorly sorted clay, sand, and rock fragments from glacial deposition that formed hummocky and lateral moraine ridges. The native materials on the site are from the Quarzar-Varden complex on the upper slopes and Howardsville gravelly loam in the lower elevations (Natural Resources Conservation Service [NRCS] 2007).

The property was owned by Seth R. Beckwith and Thomas Francis Walsh from the late 1800s. The property was owned by Duane Eggett from 1979 to 1990 and by the Lancaster Trust from 1990 until 2004 when San Juan County acquired the property (San Juan County 2005a).

A smelter was constructed on the property in 1882 and operated as an ore crushing facility and a coal-fired blast furnace producing silver, lead, and some gold. The smelter was comprised of a roaster building containing four roasting units, a smelting room with a pair of rectangular wrought iron furnaces, an ore house, an engine and boiling house, a sampling and assaying laboratory, and an office building

(Nossaman 1998). Operations also included a railroad siding from the Denver and Rio Grande Railroad and a waste slag pile (San Juan County 2005a).

Coarse/heavy slag from smelter operations is visible in the area south of the escarpment (San Juan County 2005a). The property was never redeveloped and a small portion of the western part of the property may have been mined for gravel. The fine slag that is visible only on the part of the property north of U.S. Highway 550 and south of the railroad grade may have been deposited on site and may not be related to smelter operations (San Juan County 2005b). Much of the fine slag observed in historic photographs of the property has been removed (San Juan County 2005a). Finally, a brown fibrous plaster, suspected of being asbestos-containing material, appears to have been dumped on site in one small area. The suspect material was investigated and removed from the Smelter Site under the supervision of Phase Com, a certified asbestos inspector on November 22, 2008 and the removal action was documented in a separate report (Phase Con 2008a; Phase Con 2008b).

A Targeted Brownfields Assessment revealed near-surface soil and slag containing lead and arsenic. A further Human Health Risk Evaluation (UOS 2006) determined that, at some locations, lead and arsenic soil concentrations pose an unacceptable potential human health risk if the site is redeveloped for residential use. Because it is to be developed for residential use and open space, it is necessary to remediate the site to mitigate and/or eliminate exposure pathways thereby reducing these risks to acceptable levels prior to redevelopment.

Drilling and sampling of exploratory boreholes on the Smelter Site in 2004 indicated that the unconsolidated deposits have been impacted with heavy metals associated with the smelting of ores. Soil sample results indicate that only arsenic and lead concentrations exceed the CDPHE proposed soil clean up values for residential and open space development. Total lead and arsenic concentrations were selected as the indicator parameters for the Smelter Site. The depth of lead impacted soils (lead concentrations above the CDPHE proposed residential cleanup value) was generally one to two feet, but was recorded up to four feet below ground surface (bgs). Groundwater was not encountered in any of the boreholes drilled on site, with the deepest boreholes at 24 feet bgs. Synthetic Precipitation Leaching Procedure (SPLP) results indicated that while arsenic, barium, cadmium, chromium, and lead were present in the samples, arsenic, chromium, silver, and selenium did not leach (undetected) under SPLP test conditions (EPA 1312A/6010B and 1312/7440A). Lead, barium, cadmium, and mercury indicated a potential to leach at low levels given sufficient exposure time (18 hours or more) and low pH contact water (pH $\leq$ 5.0). Surface water and groundwater are not present on the Smelter site, and therefore leaching is not an anticipated pathway of concern.

The Site Remediation Implementation Work Plan for the Smelter Site states that soils above the CDPHE proposed residential and open space soil cleanup values for lead and arsenic will be excavated and consolidated on the south side of the Smelter Site. The consolidated impacted soil area will be separated into two categories- soils with lead values above 1495 mg/Kg (referred to hereafter as high level soils) and soils with lead values 1494 mg/Kg and below (low level soils). The high level soils will be capped in the middle of the consolidation cell with low level soils at the bottom and top layers. The purpose of this layering is to separate the high level soils from potential surface and subsurface water that may move through the site with seasonal precipitation. Further separation of impacted soils and any potential water run off or run on will be managed through appropriate stormwater controls. The consolidated soils will be compacted in six-inch lifts, covered with twelve inches of compacted, clean soil as a cap, covered with twelve inches of topsoil, and vegetated with a mix of native grasses, forbes, and trees. Trail areas will be covered with six inches of compacted sub-base and four inches of pavement. Roads will be covered with six inches of compacted sub-base and four inches of County approved road base.

For residential and open space areas, capping, seeding, and road construction of the graded area will be

dependent on development plans. After soil consolidation and confirmation sampling, the Smelter Site will be contoured to accommodate two residential streets, housing lots, railroad grade trail, and stormwater controls. In general, the sloped areas will be seeded and road/parking areas would receive gravel material for surface cover. Impacted soils will not be transferred off of the site; however, miscellaneous materials such as the scrap metal and foundation timbers may be recycled as appropriate. Precipitation runoff controls will be installed and will direct surface water to a sediment control structure, which would then discharge to the two existing culverts that go under Highway 550 or towards a detention basin near the eastern entrance to the property. The culvert areas will also be improved to limit erosion including placement of rip-rap on side slopes and installation of retention structures to control flow velocities. The railroad grade trail will serve as a raised topographic feature that will direct precipitation and surface flow away from the main containment area.

Deed restrictions will be established for specific areas of the Smelter Site where affected soils will remain: 1) the containment storage cell in the community park and 2) the upper aspen-area lots where isolated areas of affected soils currently meet open space clean up goals. Affected soils that remain in these areas will be documented with geographical positioning systems (GPS) and recorded on the deed. The lower, affordable residential lots will meet CDPHE proposed soil cleanup values for residential development and not require deed restrictions after the cleanup. For the containment area, permitting will be required for any intrusive work in the impacted soil consolidation area and the environmental covenants will establish materials management controls for the maintenance of the area and revegetation standards. The containment area will have deed restrictions stating that no groundwater use is permitted, irrigation is limited to initial plant establishment, and that no decorative surface-water ponds, edible gardens, and/or fruit producing trees/vines/bushes will be allowed on the containment area. Deed restrictions for the aspen-area residential lots will state that no decorative surface-water ponds, edible gardens, and/or fruit producing trees/vines/bushes will be allowed outside of their designated building envelop; however, the building envelop will meet CDPHE residential standards.

Inclusion in the Voluntary Cleanup Program is desired for the following reasons:

- The contaminants identified on the Smelter Site are Bevill-excluded (i.e., they are not considered a hazardous waste and thus can be handled as a solid waste on the site) and were released prior to the promulgation of the Resource Conservation and Recovery Act (RCRA) or Colorado's adoption of the State Hazardous Waste Act, and would, therefore, not be regulated under these rules;

- Background soil samples from the native soils surrounding the site have arsenic concentrations greater than the CDPHE proposed cleanup values for residential development.

- Groundwater has not been detected on the site, and the SPLP test results showed that the impacted soils do not leach under normal precipitation and runoff conditions. Because any future site development will use City of Silverton water, groundwater is not considered a pathway of concern.

- The selected remedial action will consolidate and isolate the impacted materials with a clean, compacted soil cap and compacted road base and gravel, thereby, limiting any potential exposure pathways; and

- The onsite development will primarily include residential and open space use; these land uses will utilize potable water and sewer services supplied by the Town of Silverton Public Works Department. The Town of Silverton and San Juan County will develop utilities on the site and accommodate the annexation of the property into the Town of Silverton through an Inter-Governmental Agreement. (IGA).

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ACRONYMS

bgs	Below Ground Surface
CDPHE	Colorado Department of Public Health and the Environment
CLP	Contract Laboratory Program
COC	Contaminants of Concern
EPA	U.S. Environmental Protection Agency
ESAs	Environmental Site Assessments
FSP	Field Sampling Plan
HASP	Health and Safety Plan
HWS	HWS Consulting Group Inc.
mg/kg	Milligrams per Kilogram
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSL	Mean Sea Level
PRG	Preliminary remediation goals
QA	Quality Assurance
QAO	Quality Assurance Officer
QAP	QA Plan
QAPP	Quality Assurance Project Plans
QC	Quality Control
RALs	Remedial Action Levels
RBC	Risk-Based Concentrations
Smelter Site	Rose Walsh Smelter Site
SJC	San Juan County
SPLP	Synthetic Precipitation Leaching Procedure
SWCA	SWCA Environmental Consultants
TCLP	Toxicity Characteristic Leaching Procedure
UOS	URS Operating Services, Inc.
XRF	X-ray Fluorescence

1.0 INTRODUCTION

San Juan County ("the Applicant") submits this Voluntary Cleanup Plan (VCUP) Application for property known as the Rose Walsh Smelter Site (hereafter referred to as the "Smelter Site"). The Smelter Site is located on a hill slope immediately east of U.S. Highway 550 and northwest of the Town of Silverton, Colorado (Figure 1). This VCUP Application has been developed in accordance with the Colorado Department of Public Health and Environment's (CDPHE's) Voluntary Cleanup Program, pursuant to the Voluntary Cleanup and Redevelopment Act.

1.1 PURPOSE

This VCUP Application has been prepared by SWCA Environmental Consultants (SWCA) on behalf of San Juan County, to assist CDPHE in the assessment and evaluation of the Smelter Site for inclusion in the Voluntary Cleanup Program given the current environmental condition and planned current and future use of the Smelter Site.

1.2 ORGANIZATION OF THE VOLUNTARY CLEANUP PLAN APPLICATION

The following information is included in this VCUP Application. Section 2.0 includes VCUP forms including "General and Project Information" and "Program Inclusion Assessment." The historical land use of the Smelter Site is summarized in Section 3.0. In Section 4.0, environmental investigations previously conducted at the site are summarized. The present environmental condition of the Smelter Site is discussed in Section 5.0, along with summary discussions of the chemicals of concern. Section 6.0 provides a discussion of the selected cleanup levels and precautions taken to limit potential risk to human health and the environment. Remediation plans and engineering controls are discussed in Section 7.0 and groundwater monitoring plans are discussed in Section 8.0. Section 9.0 provides a listing of all the reference documents, files, and/or other sources used to develop this VCUP Application.

The majority of the information contained in this VCUP Application was obtained from documents provided by San Juan County. San Juan County's boundary survey plat and title report is included in Appendix A. The proposed Anvil Mountain Master Plan and Martha Rose Community Park Concept Plan are included in Appendix B. The data and analyses that this VCUP is based upon information and analyses that were previously described in the December 2005 report *"Analytical Results Report, Rose Walsh Smelter, San Juan County, Colorado" TDD no. 0509-42* (Appendix C) and the 2006 report "*Human Health Risk Evaluation for the Rose and Walsh Smelter*" (Appendix D) that were authored by UOS Operating Services (UOS). The Anvil Mountain Master Grading Plan is included in Appendix E. The historic land use and features of the site are documented within *Martha Rose/Walsh Smelter (5SA1177) Archaeological Assessment, San Juan County* (Appendix F). These efforts culminated in the following planning documents: Site Remediation Implementation Work Plan (Appendix G); Quality Assurance Project Plan (QAPP) (Appendix H); and Health and Safety Plan (HASP) (Appendix I). In 2007, SWCA conducted additional sampling to determine a site-specific arsenic background level, researched well locations within one mile of the site, investigated the potential for groundwater leaching, conducted additional depth sampling, and investigated the bioavailability of arsenic in the vegetated soils in the aspen areas (Section 4.0).

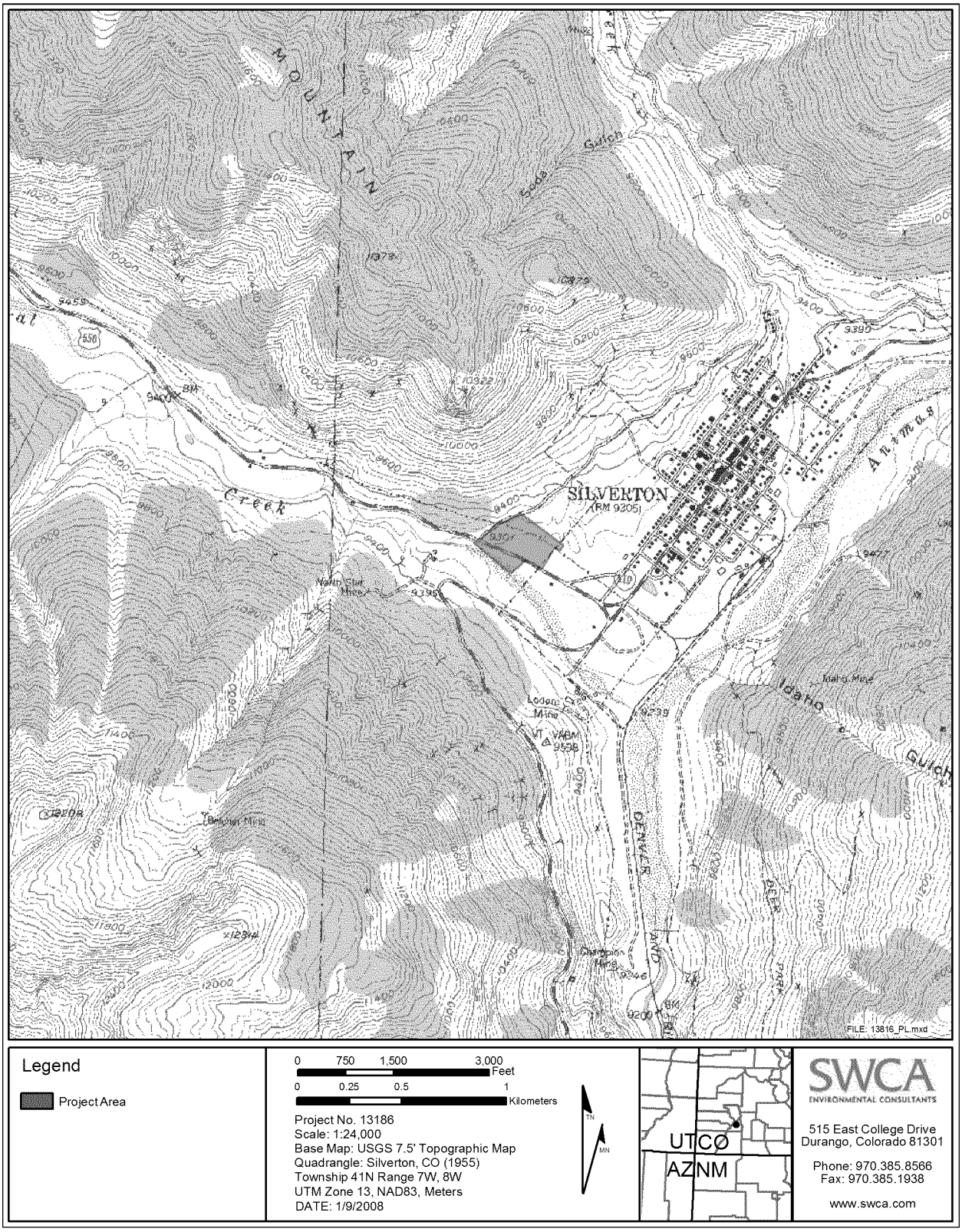

Figure 1: Rose Walsh Smelter Project Location Map.

2.0 VOLUNTARY CLEANUP PROGRAM (FORMS)

As part of the VCUP Application requirements, the following completed forms are included in this section:

- General and Project Information; and
- Determination of Inclusion in the Program.

2.1 GENERAL AND PROJECT INFORMATION

2.1.1 Name and Address of Owner

San Juan County
1557 Greene Street, P.O. Box 477
Silverton, Colorado 81433

2.1.2 Contact Person and Number

Owner:
San Juan County
1557 Greene Street, P.O. Box 477
Silverton, Colorado 81433
1-970-387-5766
Attn: William Tookey, Project Manager
San Juan County Administrator

Technical Consultant:
SWCA Environmental Consultants
515 East College Drive
Durango, Colorado 81301
1-970-385-8566
Attn: Marcie Bidwell, Environmental Manager

2.1.3 Property Location & Previous Ownership

The property is located adjacent to the town limits of Silverton, Colorado, in the Mineral Creek watershed, on the east corner of U.S. Highway 550 and San Juan County Road 6 (Shrine Road). The property is approximately 14 acres, as presented in Figure 1. The property is described as Parcel Number 4829-0.00-0.1-032 by San Juan County and is known as Tract B of the Ophir Placer (San Juan County 2005a). To the north of the site is a residential lot and the Miner's Shrine. Directly west of the property is undeveloped mountainside and some unnamed old mine adits. To the east of the site is the town of Silverton and immediately east of the site is undeveloped land. The southwest portion of the site on the south side of U.S. Highway 550 is in the floodplain of Mineral Creek (Plateau Environmental Services, Inc [Plateau] 2003, 2004). The property southwest of U.S. Highway 550 is not included within this VCUP application at this time.

The legal description for the Smelter Site is as stated below:

> "*All of Tract "B" and a tract in Tract "A" of the Ophir Placer Mining Claim, U.S. Survey No. 1124, Animas Mining District, County of San Juan, State of Colorado, being more particularly described as follows"*

Beginning at Corner No. 1, also Corner No. 1 of Tract "B" Ophir Placer Claim U.S. Survey No. 1124; thence South 54°19' East, 140.9 feet to Corner No. 2, a point on the Westerly line of the Silverton Townsite; thence South 39°05' West, 856.7 feet along said line of Silverton Townsite to Corner No. 3, also Corner No. 2 of Ophir Placer Claim; thence North 51°40' West, along line 2-3 of Ophir Placer Claim for 1150 feet to Corner No. 4, thence North 39°59'30" East, 805.0 feet; thence South 54°19' East, 998.2 feet to the point of beginning."

The property was owned by Seth R. Beckwith and Thomas Francis Walsh from the late 1800s. The property was owned by Duane Eggett from 1979 to 1990 and by the Lancaster Trust from 1990 until 2004 when San Juan County acquired the property (San Juan County 2005a).

2.1.4 Type/Source of Contamination

The Smelter Site is located northwest of Silverton, Colorado, an area historically known for its abundance of silver, gold, and other precious metals. A smelter was constructed on the property in 1882 and operated as an ore crushing facility and a coal-fired blast furnace producing silver, lead, and some gold. The smelter was comprised of a roaster building containing four roasting units, a smelting room with a pair of rectangular wrought iron furnaces, an ore house, an engine and boiling house, a sampling and assaying laboratory, and an office building (Nossaman 1998). Operations also included a railroad siding from the Denver and Rio Grande Railroad and a waste slag pile (San Juan County 2005a).

The smelter was operated by Seth Beckwith for only three days in October 1882, and produced 11 tons of bullion before bankruptcy was declared. In 1890, Thomas Walsh purchased the smelter and restarted operations. The smelter operated for approximately three years before it was closed and dismantled. Coarse/heavy slag from smelter operations is visible in the area south of the escarpment (San Juan County 2005a).

The property was never redeveloped and a small portion of the western part of the property may have been mined for gravel. The fine slag that is visible only on the part of the property north of U.S. Highway 550 and south of the railroad grade may have been deposited on site and may not be related to smelter operations (San Juan County 2005b). Much of the fine slag observed in historic photographs of the property has been removed (San Juan County 2005a). Finally, a brown fibrous plaster, suspected asbestos-containing material, appears to have been dumped on site in one small area. Remains of the former smelting operation include the former railroad grade, several small piles of scrap iron and wood, and slag (San Juan County 2005a).

Site investigations identified unconsolidated deposits of slag and cinder materials on the site that contain lead and arsenic concentrations above the CDPHE proposed soil clean up values for residential use. Background soil samples collected from surrounding properties and from the Smelter Site indicate that arsenic concentrations naturally occur in the area at levels that are greater than the CDPHE proposed soil cleanup values and are not necessarily a result of smelting or mining activities in the area (Church et al 2007). The test results from background testing are included in Section 4.0. The highest levels of lead occur in soils near the smelting operations and slag deposits, and are largely located in the immediate vicinity of the smelter works.

Groundwater and surface water were not identified during the field investigations at the Smelter Site. While several investigations drilled to depths of 8 to 24 feet, no groundwater was encountered on the site (Lambert, 2004; UOS , 2005; Engineer Mountain, 2007, 2008). Monitoring of three groundwater wells

that were installed on the site has not shown groundwater to be present. Both groundwater and surface water may occur after significant precipitation events or immediately after snow melt, with only limited exposure to onsite soils.

Synthetic Precipitation Leaching Procedure (SPLP) results indicated that while arsenic, barium, cadmium, chromium, and lead were present in the samples, arsenic, chromium, silver, and selenium did not leach (undetected) under SPLP test conditions (EPA 1312A/6010B and 1312/7440A). Lead, barium, cadmium, and mercury indicated a potential to leach at low levels given sufficient exposure time (18 hours or more contact with water of a low pH ($pH \leq 5.0$). As the mobility of lead is low and the highest concentrations of lead and arsenic on the site are predominantly in the top six inches to two feet of soils, the potential for contamination of groundwater, should it be encountered during seasonal events at the Smelter Site, is considered to be low.

2.1.5 If Contamination Will Remain on the Property Following Implementation of Your Proposal, Provide GPS Coordinates

Soils with concentrations of total metals greater than CDPHE proposed soil cleanup values for residential land use will remain on the Smelter Site in two locations: a containment cell that will be built in the community park area, and the aspen residential lots. The majority of the impacted soils will be consolidated and capped with clean soil from the site. Soils will be evaluated using CDPHE acceptable standards for each land use area (Section 6.2). Soils that are above acceptable levels will be moved to the containment area onsite and capped by 12 inches of clean soil. Some impacted soils will also be capped in place by roadways, sidewalks, pavement (parking areas), and/or clean soil and vegetation. Contaminated soils in the proposed residential aspen area that meet open space clean up goals for lead and arsenic will remain on the property. The limited presence and locations of these soils will be documented and mapped for future owners as part of an environmental covenant placed on the lots. Under the guidance of the CDPHE and procedures defined within the environmental covenants, future owners will be allowed to design the remediation strategy for these lots to include the construction of a structure, driveway, parking areas, and clean planting areas.

Soils with concentrations of total metals greater than CDPHE proposed soil cleanup values for residential land use left on the Smelter Site will be described and/or shown on maps as part of the project environmental "Remediation Construction Report," which will be submitted following completion of site remediation activities.

2.1.6 VCUP or NAD

This is a Voluntary Cleanup Plan Application per C.R.S. §25-16-304.

2.1.7 Current Land Use

The Smelter Site is currently undeveloped and has been mostly unused and undisturbed for over 40 years.

2.1.8 Proposed Future Land Use

Residential and open space use of the Smelter Site is planned. The new development will be called the Anvil Mountain Subdivision; the Anvil Mountain Master Development Plan and Martha Rose Community Park Concept Plan are included in Appendix B. The development will provide: affordable, attainable, and market rate lots for residential use; trails; historic interpretation areas; utility corridor; and open space.

2.2 PROGRAM INCLUSION ASSESSMENT

This section discusses the eligibility of the Smelter Site under the VCRA for inclusion in the Voluntary Cleanup Program. The questions answered below follow the list on pages 1 and 2 in Appendix 3 of CDPHE's Voluntary Cleanup Roadmap.

2.2.1 Is the Applicant the Owner of the Property for the Submitted VCUP or NAD? If Yes, Verify Ownership.

Yes. San Juan County acquired title to the Smelter Site in 2004 (Lambert 2004). An excerpt of the Boundary Survey Plat for San Juan County is provided in Appendix A.

2.2.2 Is the Property Submitted for the VCUP or NAD Listed or Proposed for Listing on the National Priorities List of Superfund Sites Established Under the Federal Act (CERCLA)?

No.

2.2.3 Is the Property the Subject of Corrective Action Under Orders or Agreements Issued Pursuant to the Provisions of Part 3 of Article 15 of this Title or the Federal "Resource Conservation and Recovery Act of 1976", as Amended? If Yes, Please List Order Number.

No.

2.2.4 Is the Property Subject to an Order Issued by or an Agreement (including permits) with the Water Quality Control Division Pursuant to Part 6 of Article 8 of this Title? If Yes, Please List Order or Permit Number.

No.

2.2.5 Is the Property a Facility Which Has or Should Have a Permit or Interim Status Pursuant to Part 3 of Article 15 of this Title (RCRA Subtitle C) for Treatment, Storage, or Disposal for Hazardous Waste? If Yes, Please List Permit Number.

No.

2.2.6 Is the Property Subject to Provisions of Part 5 of Article 20 of Title 8 (Underground Storage Tank - State Oil Inspector), C.R.S., or of Article 18 of this Title (RCRA Subtitle I)?

No.

3.0 PROPERTY HISTORY

The history and activities conducted at the Smelter Site were obtained from review of existing documents provided by San Juan County, Environmental Site Assessments Phase I, Environmental Protection Agency (EPA) Brownfield Targeted Assessment, and other sources.

3.1 HISTORIC LAND USE

A smelter was constructed on the property in 1882 and operated as an ore crushing facility and a coal-fired blast furnace producing silver, lead, and some gold. The smelter was comprised of a roaster building containing four roasting units, a smelting room with a pair of rectangular wrought iron furnaces, an ore house, an engine and boiling house, a sampling and assaying laboratory, and an office building (Nossaman 1998). Operations also included a railroad siding from the Denver and Rio Grande Railroad, and a waste slag pile (San Juan County 2005a).

The smelter operated for only 3 days in October 1882 by Seth Beckwith and produced 11 tons of bullion before bankruptcy was declared. In 1890, Thomas Walsh purchased the smelter and restarted operations. The smelter operated for approximately 3 years before it was closed and dismantled. Coarse/heavy slag from smelter operations is visible in the area south of the escarpment (San Juan County 2005a).

3.2 EVALUATION OF POTENTIAL ENVIRONMENTAL CONDITIONS BASED ON PREVIOUS LAND USES

As the facility was used to smelt, process, and store heavy metal precious ores from the Silverton Mining District, the Smelter Site surface area contains concentrations of heavy metals exceeding CDPHE proposed soil cleanup values for residential and open space land use. Smelting operations included coal-fired blast furnace, roasters, smelting operations for silver, lead and gold, engine and boiling works, and sampling and assaying processes (Nossman 1998). Other operations included a railroad siding track and waste slag storage (San Juan County 2005a).

4.0 ENVIRONMENTAL INVESTIGATIONS

4.1 2003 PHASE I AND 2004 PHASE II ENVIRONMENTAL ASSESSMENTS

Phase I and Limited Phase II Environmental Site Assessments (ESAs) of the site were completed for Colorado Housing, Inc. and Housing Solutions for the Southwest, Inc. (Plateau 2003 and 2004). These ESAs were conducted as due diligence activities regarding the potential purchase and development of the property for residential and industrial use (San Juan County 2005a). The Phase I ESA identified the presence of slag on the property as a recognized environmental condition. The potential for soil and groundwater contamination related to heavy metals and past smelting operations were also identified (Plateau 2003). The Phase II ESA identified arsenic, barium, and lead as contaminants of concern. During that limited investigation, slag thickness was found to be no more than 2 feet in any area (Plateau 2004).

4.2 2004 GEOTECHNICAL STUDY

A geotechnical engineering study was conducted in 2004 for Housing Solutions for the Southwest by Lambert and Associates. Nine of the 12 test bores provided data regarding the depth of the slag. No groundwater was detected to a depth of 24 feet in November 2004 when the study was conducted. Seasonal variations in subsurface water elevations were anticipated (Lambert and Associates 2004).

4.3 2005 TARGETED BROWNFIELD ASSESSMENT

Another investigation was conducted at the site by by EPA as a Targeted Brownfield Assessment (UOS 2005), and documented in Analytical Results Report, Rose and Walsh Smelter, San Juan County, Colorado (UOS 2005a) and Technical Memorandum, Human Health Risk Evaluation for the Rose and Walsh Smelter, San Juan County, Colorado (UOS 2006). The field work for this investigation was conducted on July 25, 2005, and August 17 and 18, 2005 (UOS 2005a). Field activities specifically included the collections of soil and slag samples which were analyzed for total metals, toxicity characteristic leaching procedure (TCLP) metals, bioavailability, metals speciation, uranium, pH, and acid/base accounting. Quality assurance/quality control (QA/QC) samples included x-ray fluorescence (XRF) replicates, XRF duplicates, collaborative fixed laboratory analysis, and laboratory matrix spike and matrix spike duplicate (MS/MSD) samples.

Of the 253 XRF soil sample cups, 42 were analyzed through the Contract Laboratory Program (CLP), Routine Analytical Services for collaborative total metals analysis. Twenty soil samples were analyzed by the University of Colorado in Boulder, Colorado for in-vitro bioavailibility and electron microprobe analysis geochemical speciation. Twenty-five soil and slag samples were analyzed for TCLP analysis. Eleven soil and slag samples were analyzed for uranium. Two slag samples were analyzed for pH and acid/base accounting. A radiological survey was also conducted at the site.

The 18 surface soil samples from the floodplain area (i.e. south of Highway 550) were analyzed using the XRF and the lead concentrations ranged from 98 millgrams per kilogram (mg/kg) to 1,011 mg/kg. The concentration of lead in six floodplain, subsurface soil samples analyzed using the XRF ranged from 145 mg/kg to 713 mg/kg. Lead data for 40 surface soil samples collected in the vegetated area (i.e. aspen slopes above the smelter) ranged from 56 mg/kg to 1,915 mg/kg. The concentrations of lead in 15 subsurface soil samples analyzed on the XRF ranged from 55 mg/kg to 1,294 mg/kg. The concentrations of lead in 53 surface soil samples collected in the smelter area (i.e. immediate smelter works and bench) and analyzed on the XRF ranged from 99 mg/kg to 34,677 mg/kg. The concentration of lead in thirteen subsurface soil samples analyzed on the XRF ranged from 58 mg/kg to 36,060 mg/kg.

The concentration of lead in the slag samples ranged from 1,286 mg/kg to 11,158 mg/kg. At 10 locations in the smelter area, subsurface soil samples were collected at one-foot depth intervals to a maximum depth of 10 feet below ground surface (bgs) or below the slag to determine the depth of potential metals contamination related to the fine or heavy slag or the previous smelter operations. Four core samples were collected. The results indicate that other subsurface deposits with high lead and arsenic concentrations exist that may not be associated with the smelter and that appear to have layers of soil above them with much lower concentrations of lead.

Slag and soil samples were speciated for lead, arsenic, and barium, and the samples were analyzed for bioavailability. Slag occurred with the greatest frequency, followed by iron oxyhydroxide. However, slag contained very little of the lead, arsenic, and barium present at the site. The majority of the arsenic mass was consistently found in iron oxyhydroxide and the majority of the barium mass was consistently found in barium sulfate. The mineral forms with which lead was associated were more varied, depending on the soil sample. The lead mass was found in iron oxyhydroxide, iron sulfate, lead silicate, and phosphates.

4.4 2006 HUMAN HEALTH RISK EVALUATION

EPA's subsequent risk evaluation concluded that cleanup of the site should focus on arsenic and lead (UOS, 2006). This was determined a reasonable and protective approach because arsenic and lead are the risk drivers at the site. All site-related chemicals are assumed to have the same original sources, which are related to historic smelting operations or naturally occurring metals from the surrounding areas. Other chemicals of concern (COCs) found on the site are not expected to have fate and transport characteristics that differ dramatically from those of arsenic and lead, and these COCs naturally occur with the lead and arsenic. Remedial alternatives that address arsenic and lead were also expected to adequately address the other co-located COCs. Because of EPA's decision, the risk evaluation focused on arsenic and lead in surface material and at depth in the area immediately adjacent to the smelter activities.

In the human health risk evaluation, chronic preliminary remediation goals (PRGs) were calculated. UOS collected 14 samples specifically for evaluation of the bioavailability of the metals present, following EPA recommendations to use site-specific relative bioavailability factor (RBF) derived from soil testing over generic default values. From these site-specific data, UOS derived a RBF of 0.4 for arsenic, which is lower than the EPA Region 8 default value of 0.8 (Forrest, personal comm. 2007a). For lead, the average RBF was 64 percent, which is similar to the Region 8 default value of 60 percent used in EPA's Adult Lead Exposure Model (EPA 2003) and Integrated Exposure Uptake Biokinetic (IEUBK) model (EPA 2005b). Therefore, a site-specific RBF for lead was not used (the default value was used). Exposure assumptions and toxicity values were used to calculate PRGs for child and adult residents, child and adult recreational users, adult commercial/industrial workers, and construction workers exposed to arsenic and lead in surface material (Table 4.1).

Table 4.1 PRGs for Residents, Recreation Users, and Commercial/Industrial Workers

Scenario	Arsenic PRG (mg/kg) (1E-06)	Arsenic PRG (mg/kg) (1E-05)	Arsenic PRG (mg/kg) (1E-04)	Arsenic PRG (mg/kg) (HQ = 1)	Lead PRG (mg/kg)
Child/Adult Resident	1.06	10.6	106	58.7	-
Child/Adult Recreational User	7.90	79.0	790	109	-
Adult Commercial/Industrial Worker	9.47	94.7	947	1,533	2,988
Construction Worker	14.3	143	1430	232	1,494
Adult Resident	-	-	-	-	2,797
Child Resident	-	-	-	-	400
Adult Recreational User	-	-	-	-	27,846
Child Recreational User	-	-	-	-	5,648

4.5 ARSENIC BACKGROUND STUDY AND PRE-REMEDIATION SAMPLING

In the fall of 2007, SWCA conducted additional sampling at the request of CDPHE to refine the cleanup goals in preparation of San Juan County's Voluntary Cleanup Program (VCUP) Application. The previous investigations for the Smelter Site developed a site-specific relative bioavailability factor (RBF) for arsenic for the site's smelter slag. However, no background samples were collected and RBFs were not determined for material other than the slag. In the process of refining the cleanup goals, the CDPHE requested that a site-specific background level for arsenic be determined and that bioavailability sampling be conducted for the vegetated area soils on the aspen hillslopes where slag is not present. Samples were collected at depth in the vegetated areas of the site where remediation may be required (depths up to 3 feet bgs) to determine arsenic and lead values beyond the smelter area. SWCA collected 9 background samples, 15 pre-remediation samples at depth, and 3 RBF samples (i.e., not including duplicates) for the Smelter Site.

4.6 SYNTHETIC PRECIPITATION LEACHING PROCEDURE RESULTS

In the fall of 2007, SWCA collected samples for Synthetic Precipitation Leaching Procedure (SPLP) on the contaminated materials on the site, specifically cinders, slag, and affected soils. The results suggest that while arsenic, barium, cadmium, chromium, and lead were present in the samples, arsenic, chromium, silver, and selenium did not leach (undetected) under SPLP test conditions (EPA 1312A/6010B and 1312/7440A). Lead, barium, cadmium, and mercury indicated a potential to leach at low levels. (Table 4.2).

Table 4.2 Synthetic Precipitation Leaching Procedure Results for Soils, Slag and Cinders

Metal		Silverton SPLP Sample #1	Silverton SPLP Sample # 2	Silverton SPLP Sample #3
Arsenic	Metal (mg/kg)	130	530	440
	SPLP Result	U	U	U
Barium	Metal (mg/kg)	11,000 B	640 B	550 B
	SPLP Result	0.88	0.79	2.0
Cadmium	Metal (mg/kg)	38	5.7	7.2
	SPLP Result	U	U	0.0077
Chromium	Metal (mg/kg)	14	4.5	4.7
	SPLP Result	U	U	U
Lead	Metal (mg/kg)	1,400	1,800	8,200
	SPLP Result	U	U	3.4
Silver	Metal (mg/kg)	U	U	U
	SPLP Result	U	U	U
Selenium	Metal (mg/kg)	U	22	100
	SPLP Result	U	U	U
Mercury	Metal (mg/kg)	U	0.46	1.2
	SPLP Result	U	U	0.0048

4.7 ARSENIC BACKGROUND CALCULATIONS

The Targeted Brownsfield Assessment utilized a risk-based approach to determine preliminary remediation goals (PRGs) for the site; using a 95 percent upper confidence limit of the mean (UCL) calculation, UOS and EPA determined that 58.7 ppm of arsenic would be protective of human health (HQ=1). However, two important assumptions were used in this calculation: (1) the calculations utilized a regional background level of 10 to 20 mg/kg for arsenic (15 ppm), and (2) a site specific RBF was calculated from samples of slag and soils collected from the lower portion of the site. The second assumption will be discussed in the following section, Relative Bio-Availability Factor Calculations for Vegetated Soils in Aspen Area.

CDPHE requested that SWCA collect additional soil samples to determine a site-specific arsenic background level for comparison with the EPA Region 8 regional level (15 ppm). SWCA collected 10 background samples and determined that background arsenic values surrounding the site range from non-detect to 549 ppm. To be conservative, the two highest values were removed from the sample set as potential outliers. SWCA's environmental toxicologist and Region 8 EPA Toxicologist Susan Griffith reviewed the variability within the remaining data and determined that an upper confidence level of the mean (UCL) calculation would provide an appropriate method for calculation of a site-specific background level for the area (ProUCL Version 4.0 software). Using the approved background data set, SWCA's environmental toxicologist calculated a UCL of 74 ppm as representative of site background concentrations for arsenic.

Table 4.3 Arsenic Background Sampling Results

Site Number	Sample Location Description	Arsenic (ppm)	Sample Depth (inches)
RW-B-01	hill clearing, aspen/fir	13.0	0-2
RW-B-02	aspen stand, gentle slope	32.0	0-2
RW-B-03	open slope	10.0	0-2
RW-B-04	open meadow, grassy, no slope	549.0*	0-2
RW-B-05	grazed, open grassland, low vegetation cover, compact	94.0*	0-2
RW-B-06	aspen grove, steep slope	49.0	0-2
RW-B-07	aspen grove, rocky slope, cut trees, but no soil disturbance	28.0	0-2
RW-B-08	aspen grove, gentle slope	40.0	0-2
RW-B-09	aspen grove, steep slope	55.0	0-2
RW-B-53	open slope	18.0	0-2

* Samples removed from data set prior to background calculation

4.8 RELATIVE BIO-AVAILABILITY FACTOR FOR SOILS IN ASPEN AREA

UOS collected 14 samples specifically to develop a site-specific relative bioavailability factor (RBF) for arsenic and lead for the site. However, these samples were collected primarily from the lower areas of the site where slag is more present, described by UOS as Area 3. CDPHE, EPA, and SWCA suspected that the soils upgradient of the smelter may vary from those that were downgradient and where more slag is present. SWCA tested soils in the upgradient aspen area for arsenic bioavailability to supplement the previous data set.

Table 4.4 Relative Bio-Availability Factor Calculation for Vegetated, Aspen Area Soils

Sample	As in <250u bulk soil mg/kg	mass soil (g)	calc As #1	ICP As (mg/l)	solution amt (l)	% Relative As Bioavailability
RW-V-01SU	241,525	1.02308	247.10	480	0.1	19
RW-V-02SU	37,640	1.0195	38.37	67	0.1	17
RW-V-03SU	114,155	1.03753	118.44	188	0.1	16

SWCA sent the samples to University of Colorado laboratory for analysis (the same laboratory that was used by EPA/UOS) to ensure data consistency and quality control with the UOS data. Results showed that arsenic in the aspen area had an RBF of 0.2, which is lower than the RBF for slag (level of 0.4).

5.0 EXISTING CONDITIONS

5.1 SITE DESCRIPTION

The Smelter Site is located in San Juan County immediately west of the Town of Silverton boundary, and is bounded by US Highway 550 to the south and southwest and County Road 6 (Shrine Road) to the northwest. The parcel consists of approximately 14 acres that is currently undeveloped. The former uses on the site, smelting operations and railroad facilities, altered the site by grading and contouring the naturally occurring benches to accommodate the movement of ores. A high tension powerline for Tri-State and San Miguel Power transects the site above the smelter foundation. Presently, only minimal remains of the smelter, railroad spurs, and several buildings remain on the site (Figure 2: Rose Walsh Smelter Site- Existing Conditions Map).

Most of the lower flat area is covered by rock and cobbles, low meadow vegetation, sedges, and patches of willows or aspens. The upper slopes of the site are covered with a mix of aspen and coniferous forest. The benches that traverse the site appear to be constructed of native rock and soil, with the exception of the modifications for the railroad and smelter buildings as the predominant bench that transects the site. Cinders and slag are visible on the site around the smelter foundation area and to the south of the lower railroad grade.

5.2 TOPOGRAPHY

The Smelter Site is located on a riparian terrace above Mineral Creek. Mineral Creek is the principal drainage for the area and flows to the southeast on the southwest edge of the property and is a tributary of the Animas River, located approximately 0.5 mile east of the property. The southwest portions of the property (SW of Highway 550) are likely located in the 100-year flood plain of Mineral Creek (Plateau 2004). Stormwater from the property sheet flows to two culverts and discharges to Mineral Creek in the southwest of the property. Elevation at the site ranges form approximately 9,280 to 9,390 feet above mean sea level (MSL). The topography of the site slopes steeply on the north and northwestern end of the parcel and is fairly level adjacent to Highway 550.

The nearest surface-water feature is Mineral Creek, which is the southwestern boundary of the site and located approximately 300 feet southwest of the smelter foundation and slag material. Groundwater, if present on the site, is anticipated to occur approximately 20-30 feet below grade (Plateau, 2004).

5.3 LAND USE

The Smelter Site is currently vacant and undeveloped. The area is used by local residents to access hiking trails and other public properties to the north of the parcel.

5.4 GEOLOGY

The Smelter Site lies below Anvil Mountain and within the drainage of Mineral Creek. Anvil Mountain is part of the Red Mountain complex on the western side of the Silverton caldera.

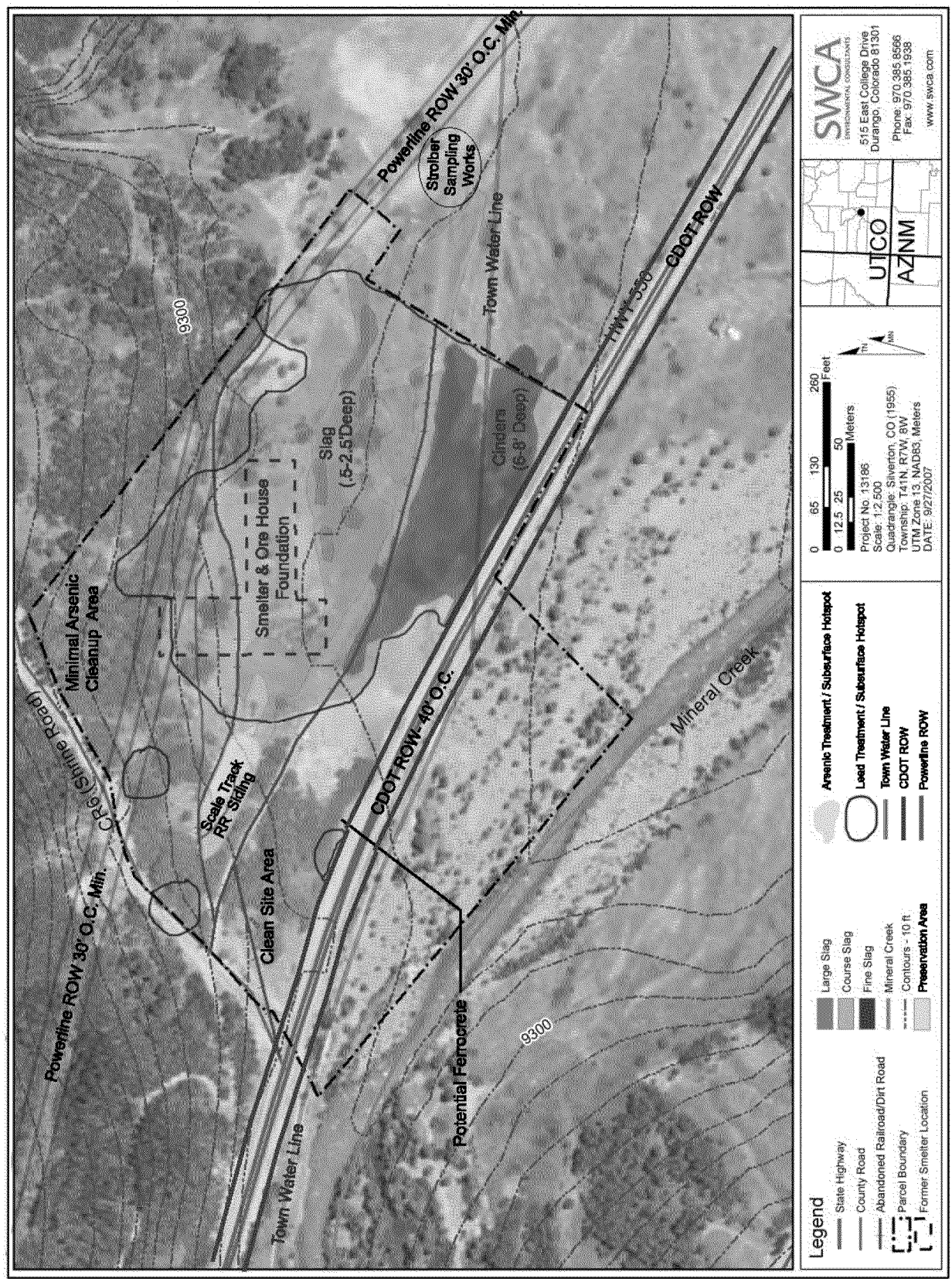

Figure 2: Rose Walsh Smelter Site- Existing Conditions Map

Volcanic activity associated with the Silverton caldera created high levels of alteration, naturally occurring mineral deposits with variable amounts of alteration in the basin (Church, et al. 2007). At the Smelter Site, the geology consists of unconsolidated sand and gravel deposits from Mineral Creek riparian terraces and glacial till deposits. The glacial till is unconsolidated and poorly sorted clay, sand, and rock fragments from glacial deposition that formed hummocky and lateral moraine ridges. The native materials on the site are from the Quarzar-Varden complex on the upper slopes and Howardsville gravelly loam in the lower elevations (Natural Resources Conservation Service [NRCS] 2007). Laterally extensive non-mining related ferrocrete deposits are known to exist along Mineral Creek indicating that acidic drainage (high in copper and arsenic) as a result of natural weathering of altered rocks has been occurring for thousands of years (Church et al, 2007). Ferrocrete deposits may exist on the Smelter Site below ground surface (Yager et al, 2005).

5.5 HYDROGEOLOGY

The hydrogeology of the site is determined by the unconsolidated deposits and no bedrock has been discovered on the site. Onsite drilling encountered sand, cobbles, gravel, and cinder/slag deposits. Drill holes were completed to depths between 8 to 24 feet before refusal. Drilling did not encounter groundwater or bedrock at these depths. Limited groundwater may occur in the unconsolidated deposits after significant snow melt or precipitation events. The depth to groundwater on the site is unknown.

5.6 GROUNDWATER RESULTS: SMELTER SITE AND OTHER SURVEYS

To date, groundwater has not been detected on the site, as reported in Geotechnical Engineering Study for Silverton Work Force Residential Housing Project, Silverton Colorado (Lambert 2004), Analytical Results Report Rose Walsh Smelter (URS 2005), and recent monitoring well surveys by Engineer Mountain (reports to San Juan County from Engineer Mountain, 2007-2008). Three groundwater monitoring wells were installed by Lambert and Associates in 2004 as part of the geotechnical survey (Lambert 2008). In total, these reports represent 20 borings and 3 well observations that were taken in November 2004, August 2005, and seasonally in 2007-2008, in order of the reports listed above. The wells have been dry with the exception of some wet soils during active snow melt (Engineer Mountain observation in May 2008).

Little information regarding groundwater is available from other neighboring properties, and due to several variables (topography, soils, location in the flood plain) information from these sites may not directly transfer to Smelter site. Neighboring property owner's (located to the north of the Smelter Site) well bore log did not find groundwater until 30 feet bgs (Gleason 2007).The McDougal's dug test pits for the Conoco Gas Station that is located five blocks further downstream and directly in the Mineral Creek flood plain; groundwater was detected at a depth of eight feet bgs (San Juan County 2008).

5.7 GROUNDWATER USES IN THE AREA

A water well record summary was obtained by SWCA from the Colorado Division of Water Resources for an approximate one-mile radius surrounding the Smelter Site. Five active well permits and one expired permit were located. Review of the active water well records indicates that four of the wells identified were classified as domestic, and one was reported as commercial. The expired permit was for a

fish hatchery that no longer exists. Four of the wells were identified as hydraulically upgradient and/or higher in elevation. Wells identified within the one-mile radius include wells within the Mineral Creek drainage valley:

- Section 13, Township 41 North, Range 8 West – One commercial well is listed for the northeast quarter with a completion depth of 59 feet and yield of 15 gallons per minute. The well is listed as owned by the Stephen Yatsko and the permit was enacted in 1995. Two domestic wells are listed that were completed to depths of 15–35 feet and yield approximately 15 gallons per minute. All of these wells are within the Mineral Creek drainage, unknown aquifers, and upgradient of the Smelter property.

- Section 18, Township 41 North, Range 7 West,– One domestic well is listed in the southeast quarter with a completion depth of 160 feet and 10 gallons per minute. This well is upslope from the Smelter Site. Interviews with the owner and drilling records indicate that some water was encountered approximately 30–40 feet below ground surface during the well construction, but that the flow of water was insufficient for a well.

- Section 17, Township 41 North, Range 7 West,– One expired well permit was listed for this section (expired in 1982), and its primary historic use was a fishery. No further information was available.

- Section 17, Township 41 North, Range 7 West,– One domestic well was listed in the northeast quarter with a completion depth of 153 feet and no yield information available. This well is on the opposite bank of Mineral Creek, at an elevation at least 500 feet higher than the site, in different geology. Though down-gradient from the Smelter Site, it is not likely that there is a hydraulic connection.

In summary, six wells were identified within a one mile radius of the site. Of these six wells, four (three domestic and one commercial) are hydraulically upgradient of the site. One is cross gradient and not likely hydraulically connected, and one, with an expired permit, is for a fish hatchery that no longer exits. As mentioned previously every residence or open space facility on the site will be connected to City of Silverton water.

5.8 DISCUSSION OF SITE CONTAMINATION

The surface soil and the upper portion of the unconsolidated deposits contain arsenic and lead concentrations greater than the CDPHE proposed soil cleanup value for residential and open space use. As stated previously, background soil samples collected upgradient of the Smelter Site contain arsenic concentrations greater than the CDPHE proposed soil remedial action levels. The highest levels of arsenic were found in the areas immediately surrounding the Smelter works and building foundations.

The lead concentrations in shallow soil are primarily from the Smelter Site operations including smelting of ore, on-site storage of ore, on-site storage of slag, on-site storage of cinders, and potentially from wind blown smoke from the smelting furnace. The depths at which lead concentrations are greater than the CDPHE proposed soil cleanup value for residential use are generally one foot or less, but were recorded up to 10 feet bgs in some soil cores (Figure 3). There is only a limited potential for leaching of metals or erosion of on-site surface soils to adjacent areas, since (1) both groundwater and surface water do not occur on the site, except potentially after periodic snowmelt or precipitation events, and (2) the SPLP test results indicate that the COCs on the Smelter Site are not likely to migrate through water pathways.

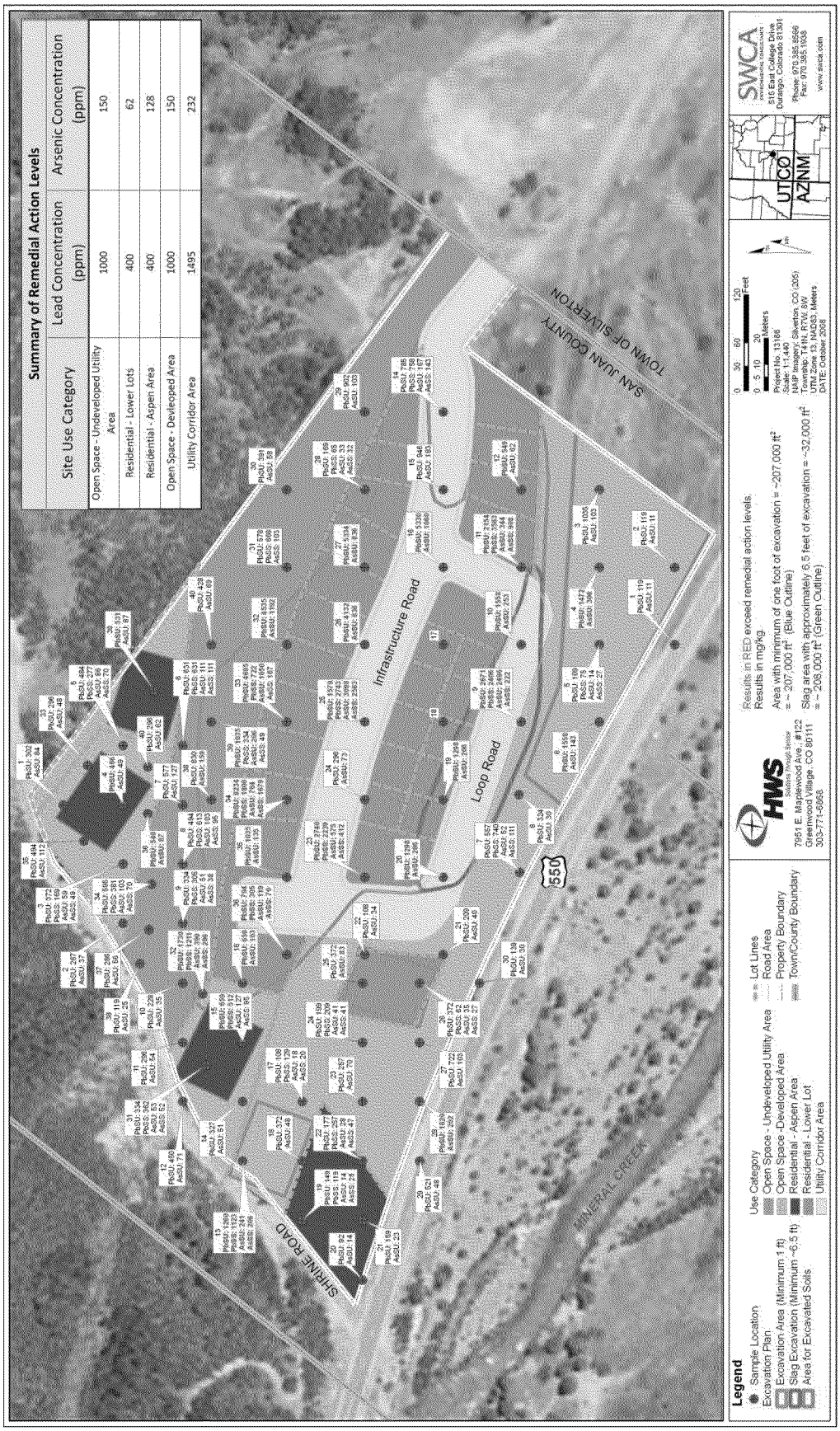

Figure 3. Site Use Categories and Remediation Map Showing Concentrations Exceeding CDHPE Limits

6.0 RATIONALE FOR SELECTION OF CLEANUP LEVELS

Applicants under the State of Colorado's Voluntary Cleanup Program are required to consider the potential current and future risks to human health and the environment associated with exposure to contaminants identified at the site. A site-specific human health risk evaluation was conducted for this site, as described in Section 4.0, and details regarding site-specific risk factors are discussed in Appendix D. Based on the information available for the Smelter Site, heavy metals (arsenic and lead) in the near surface soils are the primary contaminants of concern, specifically with regard to dermal contact or ingestion. There are a number of site-specific factors, however, that affect the actual risk posed by lead and arsenic concentrations in soil, including bioavailability. The property is planned for residential homes, multi-family homes, trails, utility corridors, and open space. A site-specific HASP was developed to ensure that construction and operational risks are acceptable.

6.1 POTENTIAL RECEPTORS

Potential exposure pathways for receptors at the Smelter Site were evaluated for future child and adult residents, future child and adult recreational users, future commercial/industrial workers, and future construction workers (UOS 2006; Appendix D). The primary future use of the site will be residential and open space. Since young children and adults could be exposed under each scenario, the entire Smelter Site was evaluated for exposure through ingestion, dermal, and inhalation exposure to surface material (including soil and slag). Construction workers could be exposed to surface material and subsurface soil during excavation of foundations for buildings, construction of recreational areas, and installation of utility lines at the site. Construction workers could be exposed to surface and subsurface soil during excavation of foundations for buildings and installation of utility lines in the floodplain preliminary area.

Potential exposure media could include surface material, subsurface soil, and ambient air. Several pathways were determined to be incomplete or negligible, and these pathways were not analyzed in detail: groundwater, surface water, ingestion of plants, and sediments. Heavy metals are typically persistent in the environment, essentially immobile in most soil, and have low water solubility, however some pathways for exposure from heavy metals exist on the site. These pathways are discussed below.

- For future construction workers, ingestion, dermal, and inhalation exposure to surface material and subsurface soil are potential receptor pathways as construction of buildings and installation of utilities have yet to be completed. These pathways will be eliminated through consolidation and capping of impacted material (Section 7.0). In addition, direct contact with affected media during excavation and/or construction will be minimal as excavators and loaders will be used with little manual labor applied to earth moving activities. Dust suppression will be used if the site conditions indicate that the soils are dry and mobile.

- Workers involved in the excavation of soils in these areas will be required to have the necessary training and required medical monitoring to comply with OSHA 1910.127. The Health and Safety Plan (HASP) and Site Remediation Implementation Plan (SRIP) developed for the site remediation would apply to all construction activities in the area. These plans define adequate personal protective equipment (PPE) and air monitoring action levels for worker protection.

- Groundwater ingestion, surface water exposure, sediment exposure and dermal exposure pathways were not evaluated. Shallow groundwater and surface water do not occur on the Smelter Site. The Town of Silverton supplies drinking water to the Smelter Site and all the adjacent land owners.

Exposure to subsurface soils is considered to be an incomplete pathway for receptors, other than construction workers, once remediation is completed.

- Exposure from edible plants was not identified as a significant exposure pathway on the site. Future environmental covenants will prevent the use of vegetable gardens in areas where affected soils will remain on the site.

6.2 SOIL REMEDIAL ACTION LEVELS

Soil remedial action levels for the Smelter Site, listed on Table 6.1, are based on the land uses proposed to CDPHE as described below.

Definition of Site Use Categories

The SJC's Anvil Mountain Master Development Plan calls for the redevelopment of the Smelter Site as affordable housing including 48 apartment units and 12 single family homes. Up to four of these homes will be located in the wooded aspen areas to the north and west of the other homes. The residences will be served by utilities located within the streets or other designated utility corridors. The site has been divided into five different Site Use Categories as shown on Figure 3. These include Open Space – Undeveloped Utility Area; Residential – Lower Lots; Residential - Aspen Area; Open Space - Developed Area; and Utility Corridors Area. Table 6.1 summarizes the RALs for all of the site use categories. Calculation of these RALs was completed using the same formula as EPA's previous risk evaluation (Appendix D, Section 3.6.1.3 PRG Equations). Only the bioavailability parameter was adjusted as noted in the description of each site use category.

Table 6.1 Remedial Action Levels

Site Use Category	Lead Concentration (ppm)	Arsenic Concentration (ppm)
Open Space – Undeveloped Utility Area	1,000	150
Residential - Lower Lots	400	64
Residential - Aspen Area	400	128
Open Space - Developed Area	1,000	150
Utility Corridor Area	1,495	232

Open Space – Undeveloped Utility Area

A power line operated by Tri-State and San Miguel Power Companies, and the associated right-of-way (ROW), runs essentially east-west across the northern portion of the site (Figure 2). The Master Plan was developed to leave an open space corridor around the power line to protect the ROW and alleviate the need for moving the location of the power poles or changing the base elevation of the ROW. To protect the workers during site remediation, a 20-foot wide corridor under the power lines, and a 50-foot radius around each power pole, will remain unexcavated.

The proposed RALs for this undeveloped, and relatively undisturbed, area are 1,000 parts per million (ppm) for lead, and 150 ppm for arsenic. The RAL of 1,000 ppm for lead, and 150 ppm for arsenic, were recommended by the Colorado Department of Public Health and the Environment.

Residential - Lower Lots

Forty-nine of the housing units will be located primarily in the central portion of the site. These units are positioned immediately adjacent to the site access roads known as Infrastructure Road, on the north, and Loop Road, to the south. Because residents of all ages may be living in these homes, the RALs for lead in this area will reflect the residential value of 400 ppm suggested by the EPA. Arsenic levels in this residential area are based on the relative bioavailability factor (RBF) of 0.4 determined for this area. This converts into a RAL for arsenic of 64 ppm in this residential area.

Residential - Aspen Area

There are four home sites located in the wooded areas to the north and west of the other homes. All four of these sites are heavily wooded with aspen trees, are larger lots, and are challenged by steep slopes. Due to these factors, a specific building envelope has not been prescribed at this time to allow for the purchaser of these lots to design a site-specific development plan that would include the building foundation, driveway, access roads, and soil caps as part of the final remediation strategy on the site. While residents of all ages may be living in these homes, the entire site will function as both residential envelope and beyond the perimeter of the dwelling, as open space – developed area. Therefore, during this cleanup the remediation goal for these lots will be considered open space – developed area, with a goal of 1000 for lead and 150 for arsenic. At the time of development, the future owner will establish and record a residential envelope for their dwelling and residential uses with the County and CDPHE. The remediation goal for lead in this residential area, once the location for the house has been selected, will reflect the conservative residential value of 400 parts per million (ppm) suggested by the USEPA. Arsenic levels in this residential area are based on the RBF of 0.2 determined for this area. This converts into a RAL for arsenic of 128 ppm in this residential area.

Open Space - Developed Area

The Open Space - Developed area is located along the southern, western, and northern edges of the site. This area is reserved for an emergency access route to the east end of the homes, the railroad grade and trail, and the historical interpretive exhibits and parking. Also, within the eastern end of this area is the proposed location of the soil containment area where the soils excavated from the site will be consolidated for permanent disposal.

Residential- Aspen Area land use includes use of the Open Space – Developed Area RALs surrounding the future locations of the homes in Lots B, C, and D of the residential – aspen area.

The proposed RALs for surface soils (upper one foot) in this area are 1,000 ppm for lead, and 150 ppm for arsenic. The RAL of 1,000 ppm for lead, and 150 for arsenic, were recommended by the Colorado Department of Public Health and the Environment.

While it may be necessary to remove contaminated soils from a few isolated locations in the western portion of this area, no removal of soils will be required in the soil containment area as the other contaminated soil excavated from the rest of the site will be placed on top of the existing ground surface.

Utility Corridor Area

The utilities will enter the site from the east. It is anticipated that most, if not all, of the utilities will be located under Infrastructure Road. The location of the utility corridor for the four homes located in the Residential Aspen Area has not yet been determined.

The *Human Health Risk Evaluation* performed by URS Operating Services, Inc. (2006) indicated that the RALs (identified as preliminary remediation goals (PRGs) by URS) for a construction worker exposed to lead in the soil is 1494 ppm. A conservative RAL for arsenic of 232 ppm for construction worker exposure has been proposed for this area based on the PRGs proposed by URS (2006).

7.0 SOIL REMEDIATION PLAN

The Smelter Site will be remediated to reduce future health risk to residents, recreationalists, commercial/construction workers and other users of the Smelter Site. The Anvil Mountain Master Grading Plan was designed in concert with soil remediation strategies described below. The complete Site Remediation Work Plan is included with this application as Appendix G. Specifically, San Juan County intends to consolidate soils with total lead and arsenic concentrations that exceed desired land use levels in the south area of the Smelter Site. These impacted soils will be capped with six inches of clean, compacted soils and six inches of topsoil and seeded. The depth of soil removal will be determined in the field based on field XRF results and guidance from Figure 3 data results. Consolidation will be completed through grading and excavation. The Anvil Mountain Master Grading Plan is included in Appendix E.

7.1 DESCRIPTION OF REMEDIAL MEASURES AND EXCAVATION TASKS

Excavation Tasks and Sequence

Prior to excavation, a stormwater management plan will be completed and stormwater controls will be installed. Soils containing asbestos were abated on the site under the direction of a licensed asbestos contractor and CDPHE-approved abatement plan in November 2008. Additionally, site controls were installed in the fall of 2008 to protect a designated area of the site for historic interpretation; contamination levels were determined to be adequate for open space use.

Affected soils will be excavated from the site following procedures and protective measures established in the Health and Safety Plan. Depths of excavation will be determined in the field using XRF to detect lead and arsenic. After the soil in a particular area has been excavated to the proposed depth, the top six inches of the newly exposed soil will be sampled by HWS personnel from five randomly selected locations within the excavation footprint for analysis. These composite samples will be field tested with the XRF device. If the XRF devise indicates that the concentrations of arsenic and lead exceed the RALs by more than 30 percent, six more inches of soil will be removed and the area will again be field screened with the XRF.

If the XRF data indicates that the soil sample is at, or near the RALs, one soil sample out of each five XRF samples collected will be submitted to the laboratory for analysis of total arsenic and lead on a rush three-day turn-around time. These laboratory samples will be sent via overnight shipping to a contract analytical laboratory for analysis. All laboratory samples will be analyzed for total arsenic and lead using SW-846 Method 6010B. A 2-day turnaround time (TAT) will be required for all analyses.

If the laboratory samples show arsenic or lead at concentrations exceeding the RALs for that site use category, an additional six inches of material will be removed and disposed of. The newly exposed surface will be resampled at five random locations at a depth of zero to six inches. Again, samples from five randomly selected locations within the excavation footprint will be collected for field testing with the XRF device and then submitted to the laboratory for analysis of total arsenic and lead on a rush three-day turn-around time. The test locations will be plotted and the data reported.

Confirmation samples will be collected only from the bottom of the excavations. Confirmation samples will not be collected from the sidewalls of the excavations. The sequencing of the excavation activities will include the continuation of excavation in a "new" area while the soil samples from the previous area

are being analyzed by the laboratory. The only downtime is expected to occur at the conclusion of excavation activities while the last confirmation samples are being analyzed. Additionally, the excavated areas must be resurveyed so that the locations where the composite confirmation samples were collected can be reported.

Affected soils above CDPHE-accepted levels from residential areas will remain in isolated pockets of the Residential Units-Aspen Area on Lots B, C, and D. As these residential lots will be developed by the purchaser of each lot, the exact development plan and building envelope has not been determined. The building footprint, roadway, driveway, and other cap material are all potential remediation strategies for these lots. Due to challenges of the steep grades and existing aspen stands, San Juan County would like to maintain the flexibility for the future owners to design a site-specific design response as part of the final remediation strategy. Therefore, at this time it is unknown whether soils need to be excavated from Lots B, C, and D in the aspen area because of the uncertainty of where a home might be located on each lot.

Placement of Soil in Containment Area

The estimated volume of soil to be stockpiled in the containment area is approximately 405,000 cubic feet (15,000 cubic yards). If the footprint of the containment area is equivalent to one square acre (43,560 square feet), the soil pile, with vertical sides, would be approximately 9.3 feet high. A larger volume of soil, or a smaller footprint, will increase the height of the pile of soil. Additionally, the sides of the soil pile must be graded at a slope so that the area can potentially be used as a park. However, the final use for this area has not yet been determined, and, therefore, the final design of the soil pile will be determined by final soil volumes and funding.

Regardless of the final slope design, the soil will be placed in maximum lift thicknesses of six inches, at a minimum compaction of 95 percent of maximum dry weight density, and at a moisture content of +/- 3 percent of the optimum moisture content as determined by ASTM D698.

Engineered Cap for the Containment Area

Engineered caps will vary by site design and generally consist of compacted soils, gravels or pavement (Figures 4 and 5). Example sections showing the design of the compacted soil cap with vegetation and design of gravel roads and paved trails are presented in Figures 4 and 5 respectively. The containment cell will be capped with six inches of compacted, clean soil and then covered with one of the following capping materials: six inches of topsoil and planted with native plants, six inches of gravel and CDOT Class Six road base (or equivalent), four inches of CDOT Class Six road base and two inches of asphalt

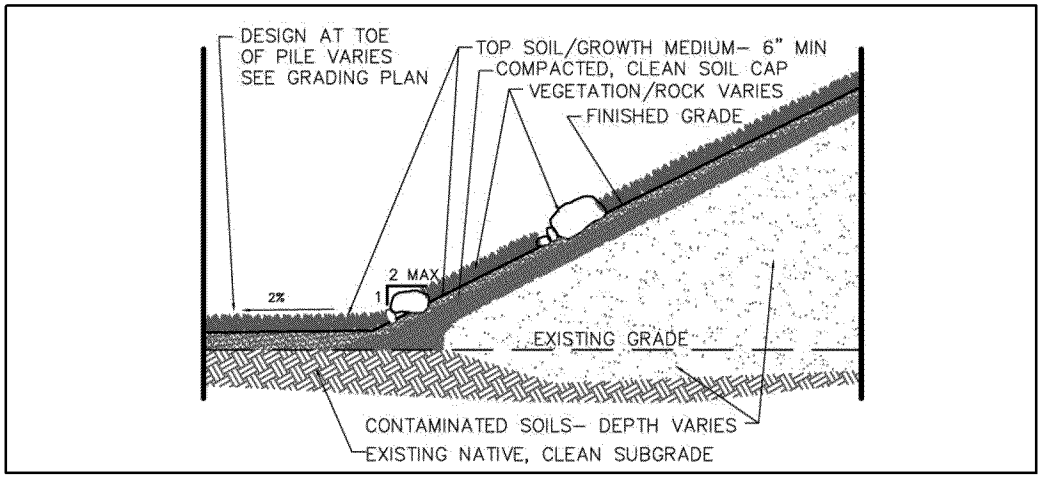

Figure 4. Example Section of Vegetated Cap with Topsoil and Plantings

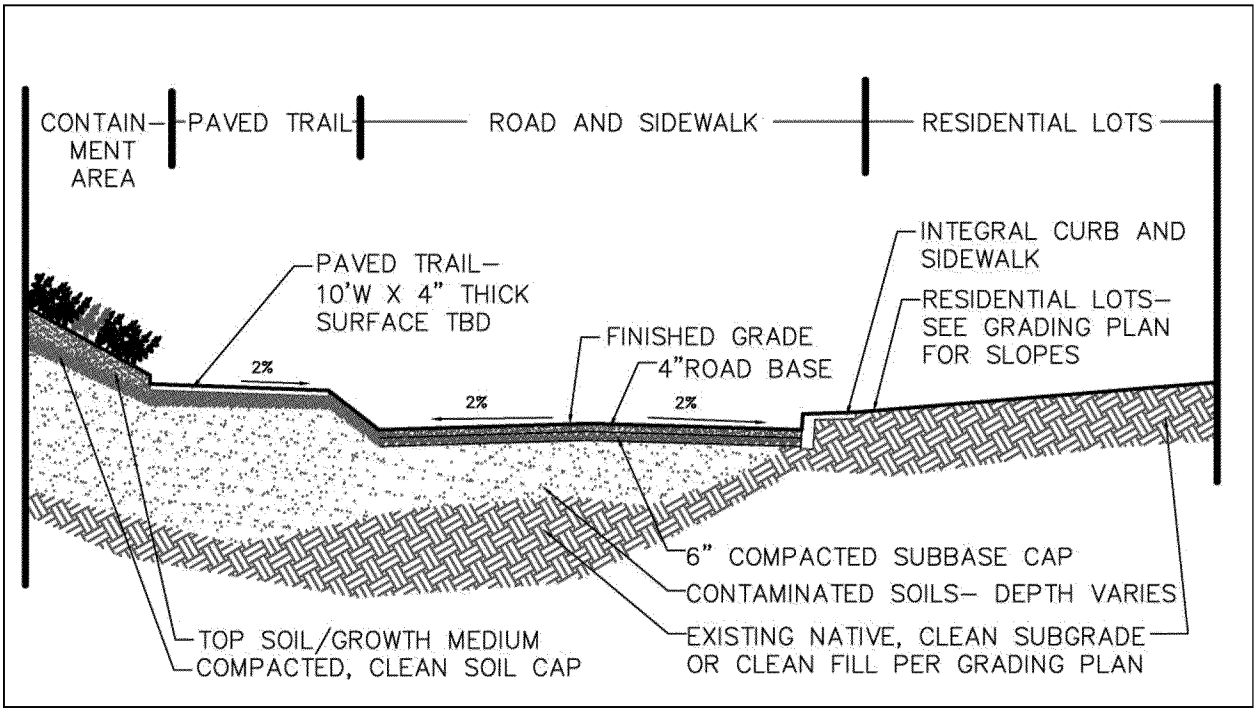

Figure 5. Example Section of Gravel Roadway or Paved Trail Cap

trail, or four inches of paved sidewalk, curb or gutter (i.e. asphalt, concrete, or soil pavement). Thickness of impermeable surfaces such as concrete and asphalt will vary dependent on pavement designs provided by the geotechnical engineer and actual application by the contractor.

7.2 SAMPLING, ANALYSIS, AND QUALITY CONTROL

Field screening with an XRF devise will be conducted by HWS personnel prior to confirmation sampling as each area has been excavated to verify that the soil containing arsenic and lead at concentrations exceeding the RALs have been removed from the Site. All health and safety requirements in the Health and Safety Plan (HWS 2008) will be followed. Soil sample collection and methodology are described in the Site Remediation Implementation Plan (Appendix G). Quality control and quality assurance measures are described in the Quality Assurance Program Plan (Appendix H).

All confirmation samples will be analyzed in the field with the XRF device, and 20 percent of the samples will be submitted to the laboratory for analysis of total arsenic and lead using SW-846 Method 6010B. Confirmation samples will be collected from each location indicated on Figure 6, which shows the minimum number of samples to be collected. Additional samples will be collected if field conditions change, or SJC, requests it. All confirmation samples will be analyzed in the field with the XRF device, and 20 percent of the samples will be submitted to the laboratory for analysis of total arsenic and lead using SW-846 Method 6010B. A 2-day turn around time will be required for all analyses.

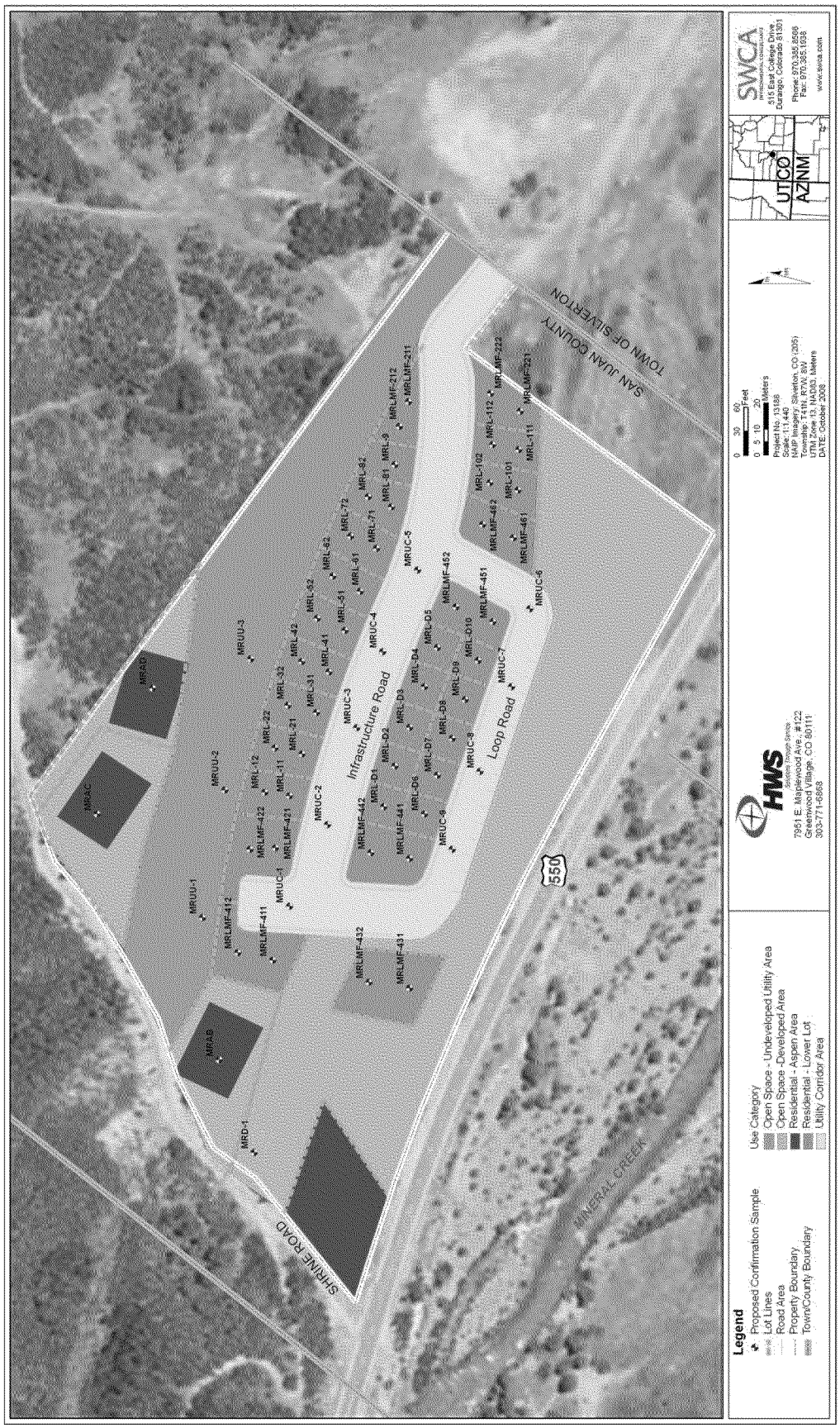

Figure 6: Confirmation Sample Locations as Determined by Lot and Land Use

A duplicate sample will be collected for every 20 confirmation samples. The duplicates will be collected as aliquots of the original sample. After the sample is mixed in a large zipper-top baggie, one aliquot will be placed in another zipper-top baggie and labeled as the duplicate. All duplicate confirmation samples will be analyzed for total arsenic and lead using SW-846 Method 6010B. A 2-day TAT will be required for all analyses.

7.3 DOCUMENTATION

A detailed account of all field activities will be noted in a field logbook. The logbook will include the identification of all samples and the analyses requested for each sample. All numbers and calculations used in the field will be printed in the logbook or noted on figures used in the field. Photographs will also be taken in the field to document different types of activities. A log of the photographs will be kept in the field logbook. This log will identify what is being photographed, the time and date, direction of the photograph, if relevant, identification of a sample, if included in the photograph, etc. Any change to this Plan must be documented either in the field logbook or on a change request form. If a change request form is used, this must be included in the Final SRI Report.

All samples will be clearly labeled with indelible ink. Each label will identify the sample, the samplers, the analyses required, and the time and date of sample collection. A chain of custody will be used for all sample shipments. The chain of custody will note the sample identification, required analyses, sample date and time, sampler, name of project, and any special notations such as "RUSH – 2 day TAT" for confirmation samples. The sampler or sample custodian will sign the chain of custody when custody of the samples is relinquished. Upon receipt of the samples at the laboratory, the sample custodian at the laboratory will sign the chain of custody to note receipt. All signed chains of custody will be maintained in the files and copies will be included in the Final SRI Report.

7.4 ENGINEERING CONTROLS

During excavation, engineering controls will be used to prevent the spread of impacted soils and to protect the health and welfare of workers. In particular, it is likely that the remediation will generate dust, which may or may not contain heavy metal concentrations. Dust suppression using a fine water mist will be used as necessary. An on-site health and safety officer will be present and will assess whether additional precautions are necessary. Should future construction be conducted in the area, the construction will follow and abide by the deed restrictions established for the Smelter Site.

Stormwater Management Plan was submitted and stormwater controls were installed on the Smelter Site in October, 2008. The stormwater BMPs are being managed by the construction contractor until excavation is completed.

8.0 ENVIRONMENTAL DESIGN, ENVIRONMENTAL COVENANTS, AND MONITORING PLANS

San Juan County has conducted extensive outreach and community engagement to determine how to best protect human health and the environment through this Brownfield project while also providing community amenities such as trails, historic interpretation, and a public park. The following lists comprehensive strategies for completing the containment area to ensure the structural longevity of the compacted cap, revegetate the containment area and Highway 550 corridor, control erosion that may threaten the cap, and protect people who may use particular areas where affected soils will remain on the Smelter Site.

8.1 ENVIRONMENTAL DESIGN CONTROLS

Several design controls will be incorporated into the final site design for the containment area, utility corridors, and trail areas to protect natural features and contain potential threats from affected soils remaining on the site. The specific construction methods for the containment cell are described in Section 7.0. This section defines environmental controls for the living surface where people will use the public spaces of the site. These controls include Martha Rose Community Park Plan and revegetation plan.

After considerable public input and discussion by San Juan County and its partners, the general park concept will be to create several paved trails and concrete platforms that will offer a flexible foundation for park use and activities, will serve as part of a hard cap for areas of the site, and will enable the future community to actively develop or adapt the site to fit their needs.

The containment area within the park will have three to four concrete platforms that vary in size(approximately 25 feet by 25 feet on average) and that are connected by both paved and natural surface trails. The final containment area and park design will be determined by the size of the containment pile and volume of soils requiring storage at the end of the clean up. However, the design will be based upon the following concept and features:

- Revegetation and cover using native riparian vegetation, rock berms, and grass/forbes on hillslopes- The design of the planting and restoration plan will reflect the transition from the riparian floodplain (to the west of Highway 550), meadow grasses, and the upper aspen forest on the upper hillslopes on the site. Runnels of rock and vegetation will create topographic variety and provide floodway direction away from the containment area should the site be flooded in the future.

- Rock terraces, benches, and dry stream channels will create natural diversions to direct potential surface water away from the containment cell and into the site drainage system. Cobbles that are six inches or larger will be screened from compacted fill cap and saved for landscaping features. Large landscape boulders will be reserved for landscaping features in the revegetation design.

- Rock and recycled vegetation- Rock from the clean portions of the site will be screened and set aside for incorporation into the landscaping plan. Trees that must be grubbed and removed from the site will be saved and used to create an informal rail fence along Highway 550 or will be chipped to create mulch or topsoil amendments.

- Temporary, salvage nursery- Smaller trees, saplings and shrubs (e.g. two inch basal diameter) will be salvaged and placed in a temporary nursery to be replanted after the clean up. These trees will be used to start the revegetation plan with larger specimens to compliment the primarily seed-based approach.

8.2 ENVIRONMENTAL COVENANTS

Deed restrictions for the Smelter Site will be developed to limit site use for parcels where contaminated soils will remain on the property (draft agreements are provided in Appendix K). Specific covenants will be written and adopted that are appropriate for each land use type, including park storage area and open space, utility and road corridors, and the upper residential lots. These controls will include restrictions on land use activities, groundwater use, and vegetation (i.e. no food-producing gardens). Surface-water ponds will be limited to two sediment control structures, one each where concentrated surface water will exit the Smelter Site. Additionally, the environmental covenants will establish permit requirements for any future excavation or construction on individual parcels where contaminated soils remain. In particular, specific restrictions, vegetation, and maintenance requirements are explicitly defined for the repository area for the consolidated impacted soil. Any future excavations at these parcels will need to follow the permitting and soil handling requirements for the proposed land use, including CDPHE-approved cleanup values contained in this VCUP.

8.3 MONITORING PLANS

Revegetation Monitoring Plan

The Revegetation Plan for the site will be finalized at the completion of the excavation, and will be designed to reflect specific site conditions including final cap soil type, necessary soil amendments, and appropriate seed mixture. The objective of the Revegetation Monitoring Plan is to analyze the success of the vegetative protective cover over the containment cells on the property. San Juan County's intent is to revegetate the containment cells largely with native, non-invasive vegetation appropriate to Southern San Juan Mountain region including grasses, wildflowers, aspen, and fir. Some horticultural varieties may be used in areas with concentrated use to enhance the park setting.

San Juan County, or its representative, will evaluate the vegetation in the containment area annually along three monitoring transects until the vegetative performance standards are met for two continuous years without irrigation. The three transects are depicted in Figure 7 as: (T1) contours the southern slope of the main containment area, (T2) ascends the northern slope of the main containment area, and (T3) traverses the top of the smaller containment area.

Revegetation performance indicators are defined as (1) the percent cover of vegetation on the site that survives after two growth seasons without irrigation, and (2) the mix of the vegetation community. Revegetation will be considered successful when the total cover reaches 75 percent of the cover present on the historic vegetation transects that represent un-impacted areas with similar slopes, moisture regimes, and soils near the site. Native species must represent 70 percent of the planting plan for the containment area. Edible plants and trees will not be allowed to grow over the containment cell or affected soils. The final vegetation community at each transect must comprise of at least two grasses and one forb.

Two transects will serve as control sites for historic vegetation cover to establish a comparative, site-specific baseline for the revegetation establishment standard. Background vegetation transect locations were selected to represent undisturbed vegetation on similar slopes, aspects, soils, elevations, exposure, and moisture conditions (Figure 7). The two transects represent 35 to 50 percent slopes, north and south aspects, representative soils consisting of poorly sorted clay, sand and rock fragments. The plant communities are primarily composed of grasses, forbs, and ground cover with occasional small trees such

Figure7. Revegetation Monitoring Transect Locations

as willow, aspen, and fir. These transects will be used to establish the expected vegetation performance standards (i.e. percentage of cover indicator) for the containment areas.

Cover will be measured at ten foot intervals along each transects in four foot square quadrats placed along side of the transect line. Within each quadrat, vegetation information will be recorded including species composition and percent aerial cover by species. Aerial cover will be classified as live stems, litter (dead vegetation both standing and down), or rock. Bands of rock may not exceed 30 percent of the area for more than 20 percent of the transect plots (i.e. community park plan may include rockscaping and rock features as part of the overall design strategy, but may not dominate the plan). Vegetation community composition must include at least two grass species and one forb species in each transect. Documentation will include establishment of key observation photo points and GPS coordinates of the transect locations. Annual monitoring reports will be provided to CDPHE. Photos will be taken at each transect from the start point looking toward the end point.

Maintenance and Monitoring Plan

San Juan County will work with CDPHE to develop a Maintenance and Monitoring Plan for the structural integrity of the containment cell. The Maintenance and Monitoring Plan will protect the containment cell from damage from use, erosion, and other causes, and provide for the preventative maintenance of the protective properties of the cap. The containment cell will be protected under this VCUP application, the environmental covenant instruments, and future memorandums of understanding between San Juan County and its partners. Maintenance and monitoring will occur annually. Specific requirements for these activities will be stipulated in the environmental covenants for the containment area.

San Juan County may choose to irrigate the site to encourage vegetation establishment, after which time the capped area may not be irrigated. An environmental covenant will be placed on the park deed to prohibit a change in the land use of the area or disturbance of the soils below the cap without prior approval of the CDPHE.

Groundwater Monitoring Plan Exclusion

Groundwater was not encountered at the Smelter Site; therefore, no groundwater monitoring is proposed.

9.0 REFERENCES

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APPENDIX A

San Juan County Boundary Survey Plat and Title Report

APPENDIX B

Anvil Mountain Master Development Plan and Martha Rose Community Park Conceptual Plan

APPENDIX C

Analytical Results Report, Rose Walsh Smelter, San Juan County, Colorado TDD no. 0509-42

APPENDIX D

Human Health Risk Evaluation for the Rose and Walsh Smelter

APPENDIX E

Anvil Mountain Master Grading Plan
Silverton, Colorado

APPENDIX F

Martha Rose/Walsh Smelter (5SA1177) Archaeological Assessment, San Juan County

APPENDIX G

Site Remediation Implementation Work Plan

APPENDIX H

Quality Assurance Project Plan

APPENDIX I

Health and Safety Plan

APPENDIX K

Draft Environmental Covenants